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Photon attenuation coefficients near L_3 edge of Pt in Pt-Rh alloy

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Abstract : Photon attenuation spectra at L_3 edge of Pt and of Pt in Pt-Rh (80%, 20%) alloy are recorded using synchrotron radiation. An analysis of the spectra revealed that the effect of alloying on the photon attenuation coefficient in Pt around L_3 edge is of the order of 12%

Keywords : Photon attenuation coefficient, Pt Rh alloy, synchrotron radiation

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A few attempts were made by Joga Rao *et al* [1], Nageswara Rao *et al* [2] and Seetharami Reddy *et al* [3] to look for the possible alloying effects on photon attenuation coefficients in the region of absorption edges. However, not much evidence was noticed. All these measurements were carried out on a good geometry set-up employing X-rays or low energy gamma rays with high resolution HpGe or Si(Li) spectrometers. In the present investigations, photon attenuation coefficients have been measured at energies around L_3 edge of Pt in Pt-Rh alloy (80%, 20%) using synchrotron radiation facility at the Laboratori Nazionale di Frascati, INFN, Frascati, Italy in order to see the possible alloying effects.

The details of the experimental set-up and the procedures of scanning the spectra were presented in an earlier publication by Parthasaradhi *et al* [4]. The spectra with and without Pt and Pt-Rh alloy foils are recorded. Subtracting the $\ln(I_o / I_s)$ obtained without the samples from the one with the sample, the absolute spectra are obtained (I_o and I_S are currents of the ionization chambers before and after the inclusion of samples respectively).

In order to study the effect of alloying on the photon attenuation coefficient at L_3 edge in Pt, the following procedure has been followed : (1) The energy scale is normalised at the point of inflection with L_3 edge energy (11564 eV) reported by Storm and Israel [5]. Based

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on this energy normalization, the data of Pt-Rh alloy is normalised. (2) To study the absolute attenuation coefficients, the spectra are normalized at about 670 eV above the L_3 absorption edge energy using the theoretical cross sections of Scofield [6] and Hubbell and coworkers [7,8]; the procedure which has already been used in our earlier work [4]. At these energies, the oscillatory behaviour is significantly small. Such a normalization procedure minimises the

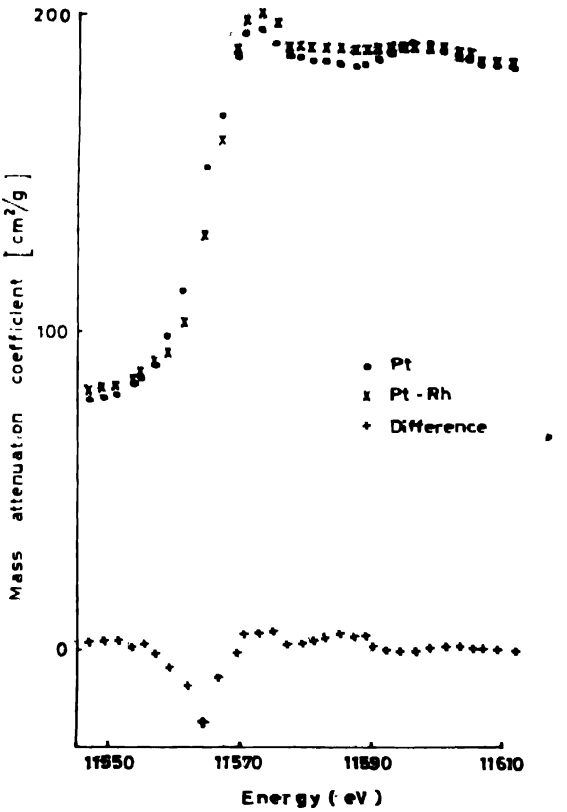

Figure 1. Photon mass attenuation coefficients around L_3 edge of Pt and Pt from Pt-Rh (80%, 20%) alloy.

error, particularly due to uncertainties in weight, non-uniformity of the foils, scattering and secondary fluorescent radiation effects *etc*. (3) The photon attenuation coefficients of Pt are also deduced from those measured in Pt-Rh alloy by subtracting 20% of the theoretical contribution of attenuation coefficient of Rh. The contribution is calculated by adding the photoelectric cross sections of Scofield [6] and scattering cross sections of Hubbell and coworkers [7,8] for Rh. The absolute attenuation coefficients of Pt measured directly and those deduced from the measurements made in Pt-Rh alloy are compared in Figure 1, in the region of L_3 edge of Pt. The difference between these two data are also shown in the same figure. The uncertainty in the measured values is of the order of 2%. It can be noted from the figure that the difference in the two sets of data particularly at L_3 edge is considerable. It may

be noted that Storm and Israel [5] has given only one unique edge energy whereas Scofield [6] has given two edge energies 11555 eV (Lower) and 11647 eV (Upper) separated by 92 eV. These two energies are below and above the edge energy of Storm and Israel [5]. In general, no alloying effect on the photon attenuation coefficient at these two energies of Scofield [6] has been noticed. However, it may be noted from the figure that the alloying effect on the photon attenuation coefficient at the L_3 edge energy of Storm and Israel [6] is of the order of 12%. Since the scattering contribution to the photon attenuation coefficient is small in this energy region the observed alloying effect can definitely be attributed to the photoelectric process only

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